Plastic Bag With Integral Tie Strip

Field of the Invention

This invention relates generally to a plastic bag product having an integral tie strip, and a method of manufacturing such a product.

Background of the Invention

The most basic disposable plastic garbage or storage bags typically comprise a pair of overlapping plastic films having an open top edge, a pair of closed side edges and a bottom edge closed by a bottom weld. Alternatively, the bag may have a tubular body open at one end with the opposed end being welded to form a closed bottom edge. Before application of the bottom edge weld, the side edges of the bags can be inwardly folded to form side gusset bottom welded bags or star seal bottom welded bags. The bag opening can be temporarily closed by a separate closure mechanism such as wire twist ties. However, such closure mechanisms tend to be awkward to apply to the bag, often requiring both hands to handle the closure mechanism. Also, such separate closure mechanisms tend to get separated from the bag product and lost. Examples of such bag products with separate closure mechanisms are disclosed in US patents 3,633,247; 3,662,434; 3664,575; 3,972,469; 3973,610; 3,997,943 and 4,077,562.

Attempts have been made to develop more complex bag products that integrate a closure mechanism into the bag's body. For example, tie elements have been integrated into the body of the bag. An example of such bag products are disclosed in US patent 5,044,775. These bag products require manufacturing processes that are relatively complex and time consuming, and manufacturing machines that are relatively expensive. Moreover the tie elements cannot be incorporated in bags with two sides gusseted or with a star seal welded bottom.

It is also known to provide a channel in the bag body to receive a tie element. An example of such a design involves producing a hem on the bag that receives a tie element threaded therethrough. Such a hem requires additional

bag material and manufacturing steps, thereby resulting in a more expensive and complex product that is relatively time consuming to manufacture. Examples of such bag products are disclosed in US patents 3,029,853 and 3,506,048.

In yet another bag product design, the tie element is attached to the bag product by an adhesive, and can be separated from the bag for use in tying closed the bag opening. Such adhesives tend to add significant expense to the manufacture of the bag product. Also, when the tie element is separated from the bag, the user typically uses both hands to tie the tie element around the bag opening, which can be awkward as he must also hold the bag at the same time. US patents 3,412,926 and 3,974,960 are examples of such bag products.

A further bag product design is disclosed in Philippine Patents UM 5406 and UM 5419. In this design one end of a tie strip is secured to the bag at a bottom weld closing the bottom of the bag. The other end of the tie strip may be detachably spot sealed to the bag near the bag opening. The tie strip has perforations adjacent the bottom weld to allow complete detachment of the tie strip from the bag so that the tie strip can be used to wrap around and close the bag opening.

In an alternative bag product design, one end of the tie strip may be secured at the bottom weld of the bag as previously mentioned, with the other end loose as disclosed in Philippine Patent UM 7402. Alternatively, the top end of the tie strip may be welded to one layer or sheet of the bag whilst the bottom end of the tie strip is secured at the bottom weld as disclosed in Philippine Patent UM 7433. The tie strip is provided with perforations positioned immediately below the top weld to enable the tie strip to be detached and used to wrap around and close the bag. In both of the designs disclosed in Philippine Patents UM7402 and UM 7433 the loose end of the tie strip is used to wrap around and close the opening whilst the other end of the tie strip remains attached to the bottom of the bag.

It is an object to provide a closable bag product that is an improvement over known closable bag products.

Summary of the Invention

According to a first bag product of the first aspect of the present invention, there is provided a bag product comprising an open ended flexible plastic film bag and a flexible plastic elongated tie strip attached to the bag. The bag has at least a first and second layer of plastic film and a bottom edge weld closing the bottom of the bag opposed the bag opening. The tie strip has a first end and a second end, the first end being secured to the first layer of plastic film adjacent the bag opening by an intermittent weld and the second end of the tie strip being secured to the bag at the bottom edge weld. The intermittent weld further detachably secures the first layer of plastic film to the second layer of plastic film. The tie strip has transversely extending perforations to enable a first portion including the first end of the tie strip to be separated from a second portion including the second end of the tie strip, whereby the first portion is secured adjacent the bag opening by the intermittent weld and is of sufficient length to wrap around and securely close the bag opening.

Such a bag product can be used in the disposal of trash, as a lawn bag, as a laundry bag and the like. The bag can also be used for packaging of products that may need a tie to be used and reused in closing the bag containing unconsumed contents. These are only a few of the many useful applications of the bag according to the present invention.

As the first portion of the tie strip is securely attached adjacent the bag opening, the tie strip is therefore readily available for a person to use for wrapping around the bag opening and closing the bag securely when needed. The closing of the bag opening with the integral tie strip can be easily performed with one hand leaving the other hand free to securely hold the bag. As the tie strip is secured near the top of the bag it does not fall to the ground if a user loses their grip on the tie strip in the closing procedure, and it is easy to relocate the tie strip and start again. Furthermore, because the same welding step can be used to weld close the bottom of the bag as well as

securely attaching the second end of the tie strip to the bag, feeding of the tie strip and bag film material into the bag making machine is together and simultaneous. Therefore manufacture of the bag product is simplified and made more efficient resulting in lower manufacturing costs.

The intermittent weld securely attaches the first end of the tie strip to the bag so that the first end of the tie strip remains attached to the bag during normal use of the bag and can thus be utilised to close and secure the bag opening when needed. As the tie strip remains attached to the bag, it can be reused to securely close the bag opening if the bag is reused. The intermittent weld also detachably secures the first layer of the bag to the second layer of the bag adjacent the bag opening, however the two layers can easily be separated with little or no damage to the bag. As there is no need to separate and insulate the first layer from the second layer of plastic film material prior to the welding step, the use of an intermittent weld to secure the first end of the tie strip adjacent the bag opening simplifies manufacture of the bag product, making the manufacture more efficient resulting in lower manufacture costs.

The location of the transverse perforations depends on the length of the tie strip needed to wrap around and secure the bag when the tie strip is separated at the perforations into two portions. The first portion secured adjacent the bag opening should be of sufficient length to be able to wrap around the bag opening easily and close it tightly and securely with knots. The first portion of the tie strip should not be too long, nor too short, such that closing the bag opening is inconvenient.

The second bag product of the first aspect of the present invention comprises an open ended tubular plastic film folded inwards at least on one side to form a side gusset with four overlapping layers of plastic film and closed at the bottom by a bottom edge weld opposed the bag opening, resulting in a side gusset bottom weld bag. The tie strip is positioned in the gusset area with the intermittent weld securing the first end of the tie strip to the first layer of plastic film and detachably securing the first layer to the second layer of plastic film in the side gusset area. The intermittent weld may also detachably secure the second layer to the third layer and the third layer to the fourth layer of plastic

film in the side gusset area. The layers of plastic film are easily separated with little or no damage to the plastic film, thus there is no obstruction of the opening in the side gusset area of the bag and the integrity of the bag remains intact.

The third bag product of the first aspect of the present invention comprises a bag formed from an open-ended tubular plastic film with closed opposed side edges. Prior to sealing the bottom edge of the tubular film by the bottom weld, the tubular film is folded inwards along both side edges such that both inwardly folded side edge touch or nearly touch each other; the tubular film is then folded longitudinally lengthways along the point where the side edges touch or nearly touch each other to form eight overlaying layers of plastic film sealed together by the bottom edge weld. This results in a star sealed bottom-welded bag. The intermittent weld secures the first end of the tie strip to the upper layer of plastic film and detachably inter-secures the upper layer to one or more of the other layers of plastic film. The layers of plastic film are easily separated with little or no damage to the plastic film, thus there is no obstruction of the opening of the bag and the integrity of the bag remains intact.

The tie strip is preferably arranged substantially perpendicular to the bag opening and may be separated at the transversely extending perforations during manufacture.

The intermittent weld is preferably at least one row of non-continuous welds, the length of the row being substantially the width of the tie strip. Each weld in the row may be a line or dash weld, a v-shaped weld, a spot weld, a diagonally sloped weld or any other configuration.

The intermittent weld preferably comprises at least two staggered rows of non-continuous welds each comprising a plurality of gaps and welds, whereby the gaps of one row are adjacent the welds of the other row and vice versa. Preferably the welds of each of the rows comprise a plurality of dashes or spots, most preferably a plurality of dashes. This configuration advantageously makes the attachment of the first end of the strip to the first

layer of plastic film of the bag more secure whilst still allowing the first and second layers of plastic film to be separated with little or no damage.

In accordance with a second aspect of the present invention, there is provided a bag product comprising:

(a) an open ended flexible plastic bag having at least a first and second layer of plastic film; and

(b) a flexible plastic elongated tie strip;

wherein an intermittent weld secures the tie strip to the first layer of plastic film and detachably secures the first layer of plastic film to the second layer of plastic film.

The intermittent weld of the bag product of the second aspect of the present invention securely attaches the tie strip to the bag so that the tie strip ideally remains attached to the bag during normal use, and can be utilised to close and secure the bag opening when needed. The intermittent weld also detachably secures the first layer of plastic film to the second layer of plastic film however, the layers can be easily separated with little or no damage to the bag. Providing an intermittent weld to secure the tie strip to the bag simplifies manufacture of the bag product, making the manufacture more efficient resulting in lower manufacture costs.

The intermittent weld of the bag product of the second aspect of the present invention is preferably at least one row of non-continuous welds, the length of the row being substantially, the width of the tie strip. Each weld in the row may be a line or dash weld, a v-shaped weld, a spot weld, a diagonally sloped weld or any other configuration.

The intermittent weld preferably comprises at least two staggered rows of non-continuous welds, each row comprising a plurality of gaps and welds, whereby the gaps of one row are adjacent the welds of the other row and vice versa. Preferably the welds of each of the rows comprise a plurality of dashes or spots, most preferably a plurality of dashes. This configuration

advantageously makes the attachment of the first end of the tie strip to the first layer of plastic film more secure whilst still allowing the first and second layers of plastic film to be separated with little or no damage.

In the second aspect of the present invention, the intermittent weld preferably secures one end of the tie strip adjacent the bag opening. The other end of the tie strip may be free or alternatively detachably secured to the bag.

A second bag product of the second aspect of the present invention has at least one side gusset. The side gusset typically comprises four overlapping layers of plastic film at the side gusset area. The intermittent weld is positioned in the side gusset area and secures one end of the tie strip to the first layer of plastic film and further detachably secures the first layer to the second layer of plastic film in the side gusset area. The intermittent weld may further detachably secure the second layer to the third layer and the third layer to the fourth layer of plastic film in the side gusset area. The intermittent weld is so configured that the layers of plastic film in the side gusset area can be easily separated with little or no damage to the plastic film so that the integrity of the bag remains intact. The intermittent weld preferably secures one end of the tie strip adjacent the bag opening in the side gusset area. The other end of the tie strip may be free or alternatively detachably secured to the bag.

A third bag product of the second aspect of the present invention comprises a bag formed from an open-ended tubular plastic film with closed opposed side edges. The tubular film is folded inwards along both side edges such that both inwardly folded side edge touch or nearly touch each other; the tubular film is then folded longitudinally lengthways along the point where the side edges touch or nearly touch each other to form eight overlaying layers of plastic film which are sealed together by a bottom weld opposed the bag opening. This results in a star sealed bottom-welded bag. The intermittent weld secures the first end of the tie strip to the upper layer of plastic film and detachably secures the upper layer to one or more of the other layers of plastic film. The intermittent weld preferably secures one end of the tie strip adjacent the bag opening. The other end of the tie strip may be free or

alternatively detachably secured to the bag. The intermittent weld is so configured that the layers of plastic film can be easily separated with little or no damage to the plastic film so that the integrity of the bag remains intact.

According to a third aspect of the present invention, there is provided a bag product comprising:

(a) an open ended flexible plastic bag having a bottom edge weld closing the bottom of the bag opposed the bag opening; and

(b) a flexible plastic elongated tie strip having a first end and a second end, the first end being secured to the bag adjacent the bag opening and the second end being secured to the bag at the bottom edge weld, the tie strip further having transversely extending perforations to enable a first portion including the first end of the tie strip to be separated from a second portion including the second end of the tie strip, whereby the first portion is secured adjacent the bag opening and is of sufficient length to wrap around and securely close the bag opening.

In the bag product of the third aspect of the present invention, the transverse perforations are positioned such that when the tie strip is separated at the perforations into two portions, the first portion of the tie strip is of sufficient length to easily wrap around the bag opening and close it tightly and securely with knots. The first portion of the tie strip should not be too long, nor too short, such that closing of the bag opening is inconvenient.

In the bag product of the third aspect of the present invention, the first end of the tie strip is preferably secured to the bag by an intermittent weld. The tie strip is preferably positioned substantially perpendicular to the bag opening. The bag is preferably formed from a tubular plastic film and may have at least one side gusset or is a star sealed bottom welded bag.

Brief Description of Drawings

Figure 1(a), 1(b), and 1(c) are schematic perspective views of rolls of flattened tubular plastic film material which may be used to produce a bag product in accordance with the present invention. Figure 1(a) shows a roll of layflat tubular plastic film material, for converting into bottom weld bags. Figure 1(b) shows a roll of layflat tubular plastic film material with two sides gusseted formed during the film blowing process, for converting into side gusseted bottom weld bags. Figure 1(c) shows a roll of layflat tubular plastic film material with two sides fully gusseted and folded in half, for converting into star seal bottom weld bags.

Figure 2 is a schematic side view of a prior art plastic bag manufacturing line.

Figure 3 is a schematic side view of a plastic bag manufacturing line that joins tie strips to layflat tubular plastic film to produce a bag product in accordance with a first embodiment of the present invention.

Figure 4 is a schematic plan view of a welding and cutting assembly of the plastic bag manufacturing line of Figure 3.

Figures 5(a), 5(b), and 5(c) are schematic perspective views of three bag products in accordance with a first embodiment of the present invention and as manufactured by the manufacturing line shown in Figure 3.

Figures 6(a) to 6(d) are schematic front views of the steps of filling and securing closed the bag shown in Figure 5(a) by its tie strip.

Figures 7(a) to 7(f) are schematic views of examples of intermittent welds that can be used in the embodiments of the present invention.

Figure 8 is a schematic side view of a plastic bag manufacturing line that joins tie strips to a roll of layflat tubular plastic film to produce a bag product in accordance with a second embodiment of the present invention.

Figure 9 is a schematic top view of the production of the bag product in accordance with a second embodiment of the present invention, using the manufacturing line shown in Figure 8.

Detailed Description of Embodiments of the Invention

Figure 1(a) shows a roll 26A of continuous tubular plastic film material 53 flattened into a plastic strip comprising two overlapping plastic films joined by a pair of longitudinally extending side edges with an opening in the direction of the front of the roll 26A This form of material is suited for the manufacture of bottom welded bags. Figure 1(b) shows a similar roll of continuous tubular plastic film material (26B) with the side edges folded in to form two side gusset during the film blowing process. This form of material is suited for manufacture of bottom welded bags with side gussets. Figure 1(c) shows a similar roll of continuous tubular film (26C) suitable for manufacture of star-seal bottom welded bags. In roll 26C the side edges of the film have been folded inwards so that the inner folded side edges touch or nearly touch each other. The film is then folded longitudinally in half along the point where the side edges touch or nearly touch each other.

A conventional plastic bag manufacturing line 81 is shown on Fig.2. The roll of tubular plastic film material 26A (or 26B, 26C) is mounted on an unwind stand (not shown). As the roll unwinds, the tubular plastic film material 53 is released and threaded through rollers 25 and 50 and continues on to rollers 60 before it is fed into a pair of driven feed rollers 61. The pair of feed rollers 61 controls the length of the bag to be made. During the bag making process the pair of feed rollers 61 pulls the plastic film material 53 forward by rotating in preset speed and preset number of revolutions. The pair of feed rollers 61 operates in intermittent cycles and is driven by a servo motor (not shown). The preset number of revolutions of the feed rollers 61 dictates the length of the bag. At each bag making cycle when the preset revolutions of the feed rollers are reached, the servo motor applies a brake on the feed rollers 61 so that plastic film material 53 is always of the same length when fed into a bag forming machine 62.

Inside the bag forming machine 62 is a welding and cutting assembly 64. When brake is applied to the feed rollers 61, the welding and cutting assembly is activated and a welding iron 68 applies a transverse weld line and a cutting knife 66 cuts cleanly across the plastic film material 53. The transverse weld and the clean cut edge are parallel to each other and closely spaced. The transverse weld line defines the bottom weld of the bag and the adjacent cut edge defines the bottom edge of the bag. The plastic film material 53 on the downstream side of the cutting knife 66 defines the top edge opening of a previously made bag 71. A conveyor 69 conveys the bag 71 to a collection table 72.

The above describes the conventional manufacture of a bottom weld plastic bag on a bag manufacturing line as shown on Fig.2.

Referring to Figure 3, a plastic bag manufacturing line 82 is built and equipped to carry out a process of mass manufacturing plastic bags products 100 according to a first embodiment of the present invention as shown in Figures 5(a)-(c). Each bag product 100 comprises a bag 110 with a bag opening 114 and a tie strip 116 securely attached to the bag 110. The tie strip 116 can be used to wrap around and close the bag opening 114 when needed, for example after the bag has been filled up with garbage.

A roll 52 of a continuous plastic tie strip film material 55 is installed on an unwind stand. The plastic tie strip film material 55 may be single or multi ply or tubular. This tie strip film material 55 is much narrower than bag film material 53 and serves as material for the tie strips 116. Manufacture of such tie strip film material is well known in the art and is thus not discussed here.

The tie strip film material 55 unwinds from roll 52 and passes tension rollers 25 and 50. The tension rollers 25, 50 serve to position the tie strip film material 55 generally perpendicular to the bag opening 114 over bag film material 53. The tie strip film material 55 and bag film material 53 are then pulled together into a perforation machine 54 by feed rollers 61. The tie strip film material 55 is pulled over a transversely extending plate 56 inside the perforation machine 54, and the bag film material 53 is pulled under the plate

56. A perforator 58 positioned above the plate 56 is lowered onto the tie strip film material 55 timed when feed rollers 61 is at brake position, i.e. when both tie strip film material 55 and bag film material 53 are at rest and not moving. As a result, a transversely extending perforation line 118 (see Figures 5(a) – (c)) is applied across tie strip film material 55 only.

Except when the tie strip film material 55 is moving over and the bag film material 53 is moving under the plate 56, the tie strip film material 55 is at all times on top of bag film material 53 and the two films are always moving forward or stopping together. In this way the length of the bag 110 and the length of the tie strip 116 attached to the bag 110 are always the same length.

The perforation machine 54 is not fixed. It is constructed to be positionable along the length and across the width of the manufacturing line 82. Any movement of the perforation machine 54 along the length of the bag manufacturing line will alter the centre distance between the perforation blade 58 and the welding iron 68. The centre distance between perforation blade 58 and welding iron 68 defines the location of perforations 118 on the tie strip 116.

After the perforation on the tie strip 116 is made, the feed rollers 61 are activated. The tie strip film material 55 and bag film material 53 rejoin and exit the perforation machine 54. The tie strip film material and bag film materials 55, 53 then go through a series of tension rollers 60 prior to being fed by feed rollers 61 into a bag forming machine 62.

Inside the bag forming machine 62 is the welding and cutting assembly 64 shown in detail in Fig. 4. The welding and cutting assembly 64 comprises three closely spaced, transversely extending components, namely a cutting knife 66 sandwiched between a pair of welding irons 68, 70. The cutting knife 66 spans the width of the bag film material 53 and is lowered at timed intervals to cut the bag film material 53 into discrete bags 110, and the tie strip film material 55 into discrete tie strips 116. The upstream welding iron 68 ("bottom-welder") extends the width of the bag film material 53 and applies a line weld ("bottom weld" 112) transversely across the bag 110 and tie strip

116, thereby securing a bottom end of the tie strip 116 to one layer of the bag 110, as well as sealing together the two film layers of the bag 110, thereby closing the bottom of the bag 110 that is immediately upstream of the cutting knife 66. A skirt 126 extends beyond the bottom weld 112 at the bottom of bag 110.

The downstream welding iron 70 ("tie strip welder") has a length at least the width of the tie strip film material 55 and applies an intermittent weld 122 to secure the top end of the tie strip 116 to the top layer of the bag film material 53 adjacent the opening of bag 110. The intermittent weld 122 also detachably secures the two layers of bag film material 53 together. The strip welder 70 applies heat to provide at least one row of non-continuous welds, and preferably two staggered rows of non-continuous welds as shown in Figure in 7(e). Examples of the intermittent weld 122 are shown in Figures 7(a) to 7(f), which are not meant to be limiting in any way. It is envisaged that any configuration of weld can be used provided the weld is non-continuous or intermittent and gives the property of securing the tie strip to the top layer of bag film material 53 of the bag 110 and also detachably securing the two layers of film of the bag 110 together.

Certain properties of the strip welder 70 can be controlled such that sufficient non-continuous heat is applied to securely fix the tie strip 116 to the top film layer of the bag 110 by the intermittent weld 122, which also detachably secure the two layers of film of the bag 110 together. This is necessary to ensure that the tie strip 116 is securely fastened to the bag 110 during high speed bag production. As the length of the intermittent weld 122 is small relative to the overall width of the bag opening 114, together with the novel construction of using an intermittent weld 122, it has been found that the weld between the two layers of film of the bag 110 can be separated or detached without causing significant damage to the bag 110 so that the function of the bag remains intact.

While the embodiment shown in Figure 4 shows the strip welder 70 configured to apply two rows of non-continuous welds across the tie strip film material 55, the strip welder 70 can also be made to apply multiple rows of

non-continuous welds of any configuration to strengthen the attachment of the tie strip film material 55 to the bag 110, whilst allowing the two layers of the bag to be separated with little or no damage to the bag 110.

Referring to Figure 5(a) there is shown a bag product 100 produced by the manufacturing line 82 of Figure 3 comprising a bag 110 with an integral tie strip 116. The bag 110 is a bottom welded bag and the tie strip 116 is attached perpendicular and central to the bag opening. The bottom end of the tie strip is secured to the bag 110 by the bottom weld 112 whilst the top end of the tie strip is secured to the bag 110 by the intermittent weld 122. Perforations 118 are provided at a location on the tie strip 116 so that when the tie strip 116 is separated at the perforations 118 the top portion of the tie strip 116 attached to the bag by intermittent weld 122, is of sufficient length to easily wrap around the bag opening 114 and be secured with a knot. The bag 110 is partially detachably closed at its opening 114 by intermittent weld 122. In this example, the intermittent weld 122 consists of two rows of non-continuous line welds constructed so that the two layers of film of the bag film material 53 can be easily separated without causing significant damage to the bag 110. The welds in each row are staggered such that the gaps of one row are adjacent the welds of the other row and vice versa (as shown more clearly in Figure 7E). This provides that the tie strip 116 is securely attached to the bag 110 whilst allowing the two layers of the bag 110 to be easily separated with little or no damage to the bag 110.

Referring to Figure 5(b), the bag 110 includes two side gussets 132 with four overlapping layers of plastic film at each side gusset 132. This type of bag product is produced using a roll of layflat tubular plastic film material (26B) as shown in Figure 1B feed through the manufacturing line shown in Figure 3. Bag 110 is partially detachably closed at one of the side gussets 132 by intermittent weld 122. Again in this example the intermittent weld 122 consists of two staggered rows of non-continuous line welds constructed so that the layers of film attached at the gusseted opening can be easily separated without causing significant damage to the bag 110. As well as detachably securing the top two layers of film in the side gusset area (as

shown in Figure 5(b)), the intermittent weld 122 may also detachably secure the second and third layers together and the third and fourth layers together (not shown). The intermittent weld 122 is constructed so that all the bag layers attached at the gusset opening can be easily separated without significant damage to the bag 110.

Referring to figure 5(c) the bag 110 is a star-seal bottom-welded bag. This type of bag product is made using a roll of lay flat plastic tubular film material (26C), as shown in Figure 1C feed through the manufacturing line shown in Figure 3. Two side edges 133 are inwardly folded until they touch or nearly touch each other (fully gusseted) and there is a longitudinal fold 134 along the point where the inwardly folded side edges 133 touch or nearly touch each other. A bottom edge weld 126 seals the eight resulting overlaying layers of plastic film material. The intermittent weld 122 in Figure 5C also consists of two staggered rows of non-continuous line welds securing the tie strip 116 to the top layer of the bag 110 and also detachably attached the top layer to the second layer of plastic film material. The top and second layers of the bag 110 are partially closed adjacent to the opening of the bag 110, however the opening of the bag 114 can be separated without significant damage to the bag 110.

As well as detachably securing the top two layers of the film as shown in Figure 5(c), the intermittent weld 122 may also detachably secure the second and third layers together (not shown), and the third and the fourth layers together (not shown). The intermittent weld 122 may further detachably inter-secure the fourth layers to more layers underneath the fourth layer. The intermittent weld 122 is constructed so that all the layers attached at the bag opening 114 can be easily separated without significant damage to the bag 110.

Figures 6(a) to (d) show the bag 110 in use. Before filling the bag 110 shown in Figure 6(a) with for example, garbage, a user will separate the two layers of film at the intermittent weld 122. Due to the construction of the intermittent weld 122 this can be done with little or no damage to the bag 110. The user can then fill the bag 110 as shown in Figure 6(b). Once filled, the top portion

of tie strip 116 is separated from the bottom portion by tearing along the perforated line 118, as shown in Figure 6(c). The opening 114 is held closed with one hand and the tie strip 116 is wrapped or encircled around the top of the bag 110 with the other hand. The tie strip 116 can be used to secure closed the opening of the bag 110 with a knot as shown in Figure 6(d).

Referring to Figure 8 and 9, a plastic bag manufacturing line 83 is built and equipped to carry out a process of mass manufacturing plastic bag products 200 in accordance with a second embodiment of the present invention. Each bag product 200 comprising a bag 210 and a tie strip 216 securely attached to the bag 210 by an intermittent weld 222 as shown in Figure 9. In Figure 8, tie strip film material 55 unwinds from roll 52 and passes through feed rollers 90. A cutter 91 cuts the tie strip film material 55 into predetermined lengths of tie strip 216 which are generally shorter than the length of bag 210. The tie strip 216 is then fed so that it is positioned on top of bag film material 53 and perpendicular to the bag opening 224. A tie strip welder 70 applies an intermittent weld 222 to secure the top end of the strip 216 to the top layer of bag film material 53 adjacent where the opening of the bag will be. The intermittent weld 222 also detachably secures the two layers of bag film material 53 together. The tie strip welder 70 provides two rows of staggered non-continuous line welds as shown more clearly in Figure 9. The two rows of staggered non-continuous line welds securely fasten the tie strip 216 to the bag 210. As the length of the intermittent weld 222 is small relative to the overall width of the bag opening 224 and the rows of non-continuous weld lines are staggered, the weld between the two film layers of the bag 210 can be easily separated with little or no damage to the films so that the bag 210 remains functionally intact.

Examples of the intermittent weld 222 are shown in Figures 7(a) to 7(f), which are not meant to be limiting in any way. It is envisaged that any configuration of weld can be used provided the weld is non-continuous or intermittent and gives the property of securing the tie strip 216 to the bag 210 and also detachably securing two layers of film of the bag together. In cases where there are more than two layers, such as side gusseted bottom weld bag or

star seal bottom weld bag, the intermittent weld may further detachably inter-secure additional or all film layers underneath the second layer.

Certain properties of the strip welder 70 can be controlled such that sufficient heat is applied to securely fix the tie strip 216 to the top layer of film of the bag 210, and also detachably secure the two layers of the film together at the intermittent weld 222. This is necessary to ensure that the tie strip 216 is securely fastened to the bag 210 during high speed bag production. While the embodiment shown in Figure 8 shows the strip welder 70 configured to apply two rows of non-continuous welds across the tie strip film material 55, the strip welder 70 can also be made to apply multiple rows of non-continuous welds of any configuration to strengthen the attachment of the tie strip 216 to the bag 210.

The bag film material 53 with tie strip 216 attached are fed through feed rollers 61 into welding and cutting assembly 64. Feed rollers 61 work simultaneously with feed rollers 90. Cutter 91 and tie strip welder 70 are activated when the feed rollers 61 and 90 are at rest. The welding and cutting assembly 64 comprising cutting knife 66 and welding iron 68. The cutting knife 66 spans the width of the bag film material 53 and is lowered at timed intervals to cut bag film material 53 into discrete bags 210. The welding iron 68 extends the width of the bag film material 53 and applies a line weld (bottom weld 212) transversely across bag 210, thereby sealing together the two film layers of bag 210 to close the bottom of the bag immediately downstream of the cutting knife 66. A skirt 226 extends beyond the bottom weld 212 at the bottom of bag 210. A conveyor 69 then conveys the finished bag product 200 to a collection table 72.

Referring to Figure 9, there is shown a schematic top view of the plastic bag film material 53 as it proceeds through the manufacturing line of Figure 8. The tie strip 216 is attached to the plastic bag film material 53 by the intermittent weld 222 and the bag film material 53 is cut to form bag 210 with bottom weld 212, skirt 226 and opening 224. The top end of tie strip 216 is securely attached to the bag 210 adjacent the bag opening 224 by intermittent weld 222 whilst the bottom end of the tie strip 216 is free to be used to wrap

around and secure the bag opening when needed. Alternatively, the bottom end of the tie strip 216 may be detachably secured to the top layer of the bag 210 by adhesive or the like so that the tie strip 216 remains secured to the bag 210 during normal use of the bag 210. When the user wishes to close the bag 210, the bottom end of the tie strip 216 can easily be detached from the bag 210 and used to wrap around the bag opening 224 and secure it closed.

The invention is not to be limited by the embodiment shown in the drawings and described in the description, which is given by way of example and not limitation, but only in accordance with the scope of the appended claims.